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Draft Memo

To: Arizona Technical Work Group (TWG) members
From: The Center for Climate Strategies (CCS)
CC: Arizona DEQ
Re: Standard CCS methods for quantification of draft greenhouse gas (GHG) mitigation policy options
Date: April 21, 2006

This memo describes in brief the methodology CCS uses in quantifying the GHG impacts and costs of policy options, and provides some examples of the distinction between "direct" and "indirect" costs. CCS uses the following methods, widely accepted among climate change analysts:

- Focus of analysis: Net GHG reduction potential in physical units of million metric tons carbon dioxide equivalent (MMTCO2e) and net cost per metric ton reduced in units of dollars/MTCO2e.

- Geographic inclusion: Measure GHG impacts of activities that occur within the state, regardless of the actual location of emissions reductions.

- Direct vs. Indirect Effects: Define "direct effects" as those borne by the entities implementing the option. For example, direct costs are net of any benefits or savings to the entity. Define "indirect effects" as those borne by the entities other than those implementing the option. Quantify these indirect effects on a case-by-case basis depending on magnitude, importance, need and availability of data. (See additional discussion and list of examples below.)

- Non-GHG impacts and costs: Include in qualitative terms where deemed important. Quantify on a case by case as needed depending on need and where data is readily available.

- Discounted and "Levelized" Costs: Discount costs using the discount rate applied by the State in other policy arenas (or apply a real discount rate of 5% if a state-approved rate is not available). Discount a multiyear stream of net costs (total costs net of any savings) to

arrive at the "present value cost" of an option. Create a "levelized" cost per ton by dividing the "present value cost" by the cumulative reduction in tons of GHG. This is a widely used method to estimate the "dollars per ton" cost of reducing GHG emission (all in CO2 equivalence). A "levelized" cost is a "present value average" used in a variety of financial cost applications.1

- Time period of analysis: Count the impacts of actions that occur during the project time period and, using levelized emissions reduction and cost analysis, report emissions reductions and costs for specific target years such as 2010 and 2020. Where additional GHG reductions or costs occur beyond the project period as a direct result of actions taken during the project period, show these for comparison and potential inclusion.

- Aggregation of impacts: Avoid simple double counting of GHG reduction potential and cost when adding options. Note and or estimate interactive effects between policy options using analytical methods where overlap is likely.

- Policy design specifications: Include timing, goal levels, implementing parties, and the type of implementation mechanism.

- Transparency: Include data sources, methods, key assumptions, and key uncertainties.

The approaches here do not necessarily take a "standard" benefit-cost perspective as used in regulatory policy impact analysis. For instance, there is no direct/indirect distinction under standard procedures: one takes the "societal perspective" and tallies everything, and quantifies where possible. Regarding GHG mitigation costs, often the best available data is focused at the level of implementation as opposed to the societal level. Regarding GHG benefits, market prices (monetized benefits) are normally taken as good proxies of societal costs and benefits in standard analysis unless there are market imperfections or subsidies that create distortionary effects. Because we do not have good information on the dollar value of GHG reduction benefits, we use physical benefits instead, measured as MMTCO2e.

The "direct cost" approach described here is useful in estimating the costs (and benefits) to the implementing entity: person, company, governmental body, etc. "Indirect costs" (and benefits) are those experienced by other entities in society. In examining utility Demand Side Management (DSM) programs for gas and electric utilities, analysts sometimes look at three perspectives: "participant", "non-participant", and "societal" (the latter being equivalent to "standard" benefit-cost perspective). Depending on program design, "direct cost" to a DSM participant can be high or low (if the latter, it may be attributable to a shifting of some costs non-participants.

[1] For additional details and formulas, see www.tellus.org/energy/publications/policies&measures.pdf, p. 33, See especially the discussion of how some analysts advocate some form of discounting the multi-year stream of GHG reductions, while others do not.

Note also that the "direct cost" approach does not necessarily account for market imperfections or subsidies. Typically a state perspective on "direct costs" takes any federal government subsidies as a given. For example, substantial federal government subsidies exist for some alternative fuels. If the existing market price (with subsidy) of the alternative fuel is used in cost analysis, the option appears as relatively low cost. If the subsidy were included in the cost analysis (i.e., looking at societal costs in the standard benefit-cost perspective), then the alternative fuel would appear more costly.

Finally, some direct costs may look very large despite the attractiveness of the policy option for a variety of reasons, including co-benefits. For instance, in one state a bundle of Transit/Smart Growth/VMT Reductions was estimated to have a direct cost of $280/MTCO2e – a comparatively high figure -- but stakeholders still endorsed the policy option for the multiple benefits it would generate. In this case stakeholders also believed that a large state investment cost would have been incurred anyway for conventional transportation investment, and that redirection of part of this existing stream of funds to smart growth alternatives made sense. In this case the cost of the existing stream of transportation funds could have been treated as a sunk cost, and the true cost measured instead as the incremental costs of smart growth redirected funding that was over and above the BAU funding stream.

CCS will provide transparency on related data sources, methods and assumptions in its analysis of draft mitigation policy options to ensure that these issues are known, and rely on feedback from the TWGs and CCAG to identify any suggested modifications that may be needed. One key constraint we often face is the availability of data. It is not unusual for data to be imperfect and require pragmatism and transparency during analysis.

For additional reference we recommend the economic analysis guidelines developed by the Science Advisory Board of the US EPA available at: http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

Examples of Direct/Indirect Net Costs and Benefits, RCI

Direct Costs and/or Benefits

- Net capital costs (or incremental costs relative to standard practice) of improved buildings, appliances, equipment (cost of higher-efficiency refrigerator versus refrigerator of similar features that meets standards)
- Net O&M costs (relative to standard practice) of improved buildings, appliances, equipment, including avoided/extra labor costs for maintenance (less changing of CFL or LED lamp relative to incandescent)
- Net fuel (gas, electricity, biomass, etc.) costs (typically as avoided costs from a TRC or societal perspective)
- Cost/value of net water use/savings
- Cost/value of net materials use/savings (for example, raw materials savings via recycling, or lower/higher cost of low-GWP refrigerants)
- Direct improved productivity for as a result of industrial measures (measured as change in cost per unit output, for example, for an energy/GHG-saving improvement that also speeds up a production line or results in higher product yield)

Indirect Costs and/or Benefits

- Re-spending effect on economy
- Net value of employment impacts
- Net value of health benefits/impacts
- Value of net environmental benefits/impacts (value of damage by air pollutants on structures, crops, etc.)
- Net embodied energy of materials used in buildings, appliances, equipment, relative to standard practice
- Improved productivity as a result of an improved working environment, such as improved office productivity through improved delighting (though the inclusion of this as indirect might be argued in some cases)

Examples of Direct/Indirect Net Costs and Benefits, ES

Direct Costs and/or Benefits

- Net capital costs (or incremental costs relative to reference case technologies) of renewables or other advanced technologies resulting from policies
- Net O&M costs (relative to reference case technologies) renewables or other advanced technologies resulting from policies
- Avoided or net fuel savings (gas, coal, biomass, etc.)of renewables or other advanced technologies relative to reference case technologies resulting from policies
- Total system costs (net capital + net O&M + avoided/net fuel savings + net imports/exports + net T&D costs) relative to reference case total system costs

Indirect Costs and/or Benefits

- Re-spending effect on economy
- Higher cost of electricity reverberating through economy
- Energy security
- Net value of employment impacts
- Net value of health benefits/impacts
- Value of net environmental benefits/impacts (value of damage by air pollutants on structures, crops, etc.)

Examples of Direct/Indirect Net Costs and Benefits, AF

Direct Costs and/or Benefits

- Net capital costs (or incremental costs relative to standard practice) of facilities or equipment (e.g. manure digesters and associated infrastructure, generator; ethanol production facility)
- Net O&M costs (relative to standard practice) of equipment or facilities
- Net fuel (gas, electricity, biomass, etc.) costs or avoided costs
- Cost/value of net water use/savings

Indirect Costs and/or Benefits

- Net value of employment impacts
- Net value of health benefits/impacts
- Value of net environmental benefits/impacts (value of damage by air pollutants on structures, crops, etc.)
- Net embodied energy of water use in equipment or facilities relative to standard practice
- Reduced VMT and fuel consumption associated with land use conversions (e.g. as a result of forest/rangeland/cropland protection policies).

Examples of Direct/Indirect Net Costs and Benefits, TLU

Direct Costs and/or Benefits

- Incremental cost of more efficient vehicles net of fuel savings.
- Incremental cost of implementing Smart Growth programs, net of saved infrastructure costs.
- Incremental cost of mass transit investment and operating expenses, net of any saved infrastructure costs (e.g., roads)
- Incremental cost of alternative fuel, net of any change in maintenance costs

Indirect Costs and/or Benefits

- Health benefits of reduced air and water pollution.
- Ecosystem benefits of reduced air and water pollution.
- Value of quality-of-life improvements.
- Value of improved road safety.
- Energy security
- Net value of employment impacts